

TYPE LOCALITY RESTRICTIONS AND LECTOTYPE DESIGNATIONS FOR THE
"ROCKY MOUNTAIN" BUTTERFLIES DESCRIBED BY EDWARD DOUBLEDAY IN
"THE GENERA OF DIURNAL LEPIDOPTERA" 1847-1849

Jon H. Shepard
R.R. #2, Sproule Creek Road
Nelson, British Columbia
V1L 5P5

Quaestiones Entomologicae
20: 35-44 1984

ABSTRACT

Doubleday described six species of butterflies from the Rocky Mountains of North America in his "Genera of Diurnal Lepidoptera", Parnassius smintheus, Anthocharis creusa, Argynnis astarte, Melitaea anicia, Erebia mancinus, and Chionobas chryxus. The type locality of the six has been erroneously cited as near Banff, Alberta by authors. Evidence is presented to show that the type material was collected near Jasper, Alberta. Except for Argynnis astarte, each species is represented by two syntypes in the British Museum collection. Appropriate lectotypes have been designated.

RÉSUMÉ

Dans son ouvrage intitulé "Genera of Diurnal Lepidoptera", Doubleday décrit six espèces de papillons provenant des Montagnes Rocheuses nord-américaines; ces espèces sont Parnassius smintheus, Anthocharis creusa, Argynnis astarte, Melitaea anicia, Erebia mancinus, et Chionobas chryxus. Certains auteurs citèrent par erreur la localité typique de ces espèces comme étant près de Banff en Alberta. Le présent auteur avance des preuves démontrant que le matériel typique fut collectionné près de Jasper en Alberta. À l'exception d'Argynnis astarte, chaque espèce est représentée par deux syntypes dans la collection du British Museum, pour lesquels l'auteur désigne des lectotypes.

INTRODUCTION

Edward Doubleday described six species of butterflies from the "Rocky Mountains" of North America: *Parnassius smintheus* 1847, *Anthocharis creusa* 1847, *Argynnis astarte* 1847, *Melitaea anicia* 1847, *Erebia mancinus* 1849, and *Chionobas chryxus* 1849. The modern combinations of these names are, respectively: *Parnassius phoebus smintheus*, *Euchloe creusa*, *Clossiana astarte*, *Occidryas anicia*, *Erebia disa mancinus*, and *Oeneis chryxus*. The type locality for all six species was given as Rocky Mountains. The description of *P. p. smintheus* contains the additional information that it was collected in the summer of 1845 by Lord Derby's collector, Mr. Burke. An error was made in the addenda and corrections, p. 531, giving the type locality of *C. astarte* as Jamaica (Westwood, 1852).

The contradiction of Jamaica and Rocky Mountains threw into confusion the actual type locality of all six species. Between 1851 and 1891 most effort was concentrated on locating the source of *C. astarte* (Fletcher, 1908). Opinion as to the actual source of *C. astarte* was divided between the majority who thought it occurred in the mountains of British Columbia (Elwes, 1889; Strecker, 1882) and the minority represented by William H. Edwards who believed *C. astarte* to be a subspecies of *Speyeria mormonia* (Bdv.) from California (Brown, 1965). When Thomas Bean sent specimens of *C. astarte* to W.H. Edwards these were first described as

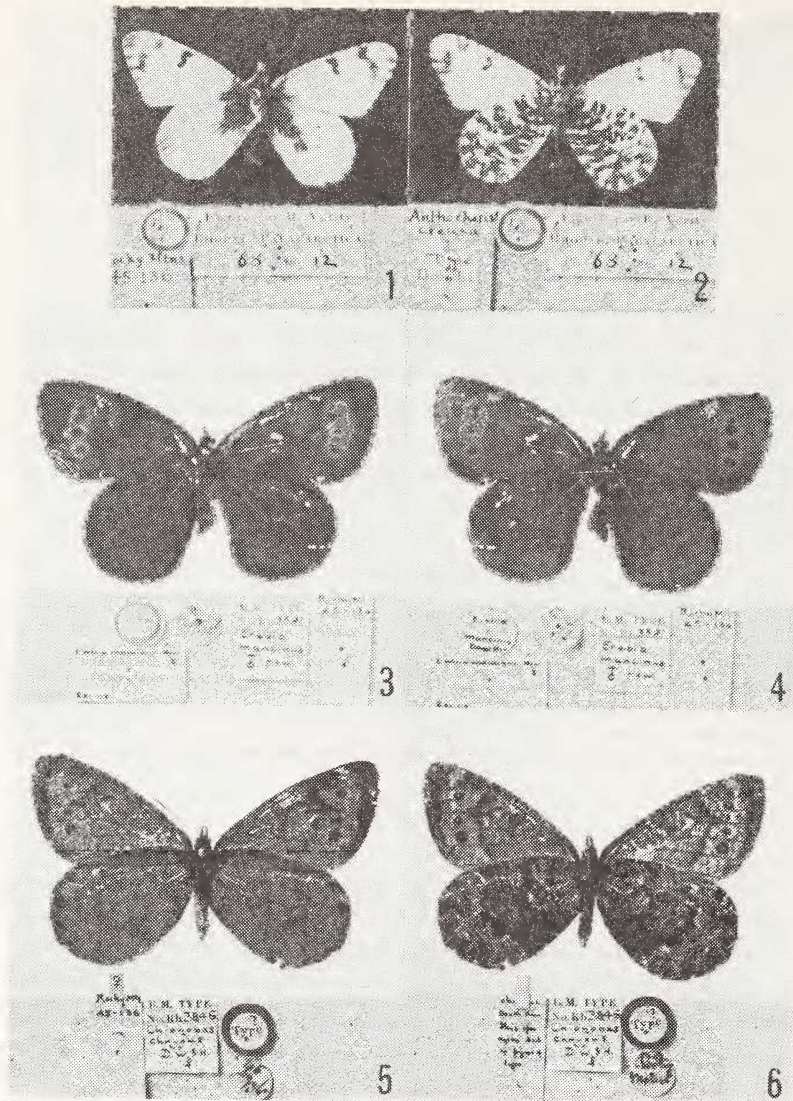


Fig. 1. Lectotype of *Anthocharis creusa*, upperside. Fig. 2. Lectotype of *Anthocharis creusa*, underside. Fig. 3. Lectotype of *Erebia mancinus*, upperside. Fig. 4. Lectotype of *Erebia mancinus*, underside. Fig. 5. Lectotype of *Chionobas chryxus*, upperside. Fig. 6. Lectotype of *Chionobas chryxus*, underside.

Argynnis victoria (Edwards, 1891), type locality Laggan, Alberta. Laggan is now known as Lake Louise, Alberta. Since this second collection of *C. astarte*, the type locality of all six species has been attributed to the vicinity of Banff, on the mistaken assumption that Banff was frequented by white men at the time *C. astarte* was collected.

F.M. Brown's statement to Opler (1967) is representative of established opinion concerning the type locality of Doubleday's species names: "the great majority of North American specimens collected by Lord Derby came from the vicinity of Banff, Alberta. I doubt that he got over to the B.C. side of the range and it is questionable that he got as far north as "Kicking Horse Pass"." Brown's statement contained another major confusion. Lord Derby, who presented the material to the British Museum of Natural History, did not collect the specimens. He either sent out professional collectors, such as Mr. Burke, or he obtained specimens from persons who had returned to England from world travels. Lord Derby, the thirteenth Earl, never travelled to western North America. In 1848 the future fifteenth Earl travelled to eastern Canada and the United States returning to England via the West Indies. The published diaries of the fifteenth Lord Derby's travels combined with the typographical error of recording *C. astarte* from Jamaica may account for the confusion of earlier authors.

For two of the species involved, *Euchloe creusa* and *Clossiana astarte*, authors have attempted to restrict the type localities to specific points. Opler (1967) restricted the type locality of *E. creusa* to the vicinity of Banff, Alberta. Pike (1980) restricted the type locality of *C. astarte* to Mount Cheam, British Columbia. Both authors were incorrect.

In crediting all the names to Doubleday and not to Hewitson or Westwood or some combination of the three names, the interpretation of Hemming (1941) is followed; that of Miller and Brown (1981) is ignored. Hewitson only drew the plates and was not responsible for the names attached. Thus, Doubleday is the sole author of the names.

Miller and Brown (1981) made the following errors in referring to the species discussed in this paper. For the species *O. anicia*, *E. disa mancinus* and *O. chryxus* they stated that each holotype is in the British Museum. There are only syntypes for these three species. The original description of *P. p. smintheus* first appeared on page 26, a fact also overlooked by Hemming (1941). The first place where the name *E. creusa* appeared in print was pl. 7, fig. 1 Hemming, (1941), not p. 56. The date of publication of the name *O. anicia* was 1847 (Hemming, 1941), not 1848. The name *Erebia disa mancinus* first appeared on pl. 64, fig. 2, not pl. 63, fig. 2. Also the name *E. d. mancinus* was first published in 1849 on the same plate as the name *O. chryxus*, and not in 1851. The name *chryxus* was first published on 2: pl. 64, fig. 1, not 1: pl. 64, fig. 2.

DISCUSSION OF TYPE LOCALITY

The original descriptions of the six species state that each was from the Rocky Mountains. In addition, it is stated that the specimens of *Parnassius phoebus smintheus* were collected in the summer of 1845 by Lord Derby's collector, Joseph Burke. There is no indication in the text that all six species were, or were not, collected by one collector or at one locality. Examination of the various series in the British Museum of Natural History shows that all specimens were presented to the Museum in either 1845 or 1847 by Lord Derby with at least one specimen of each of the six species donated in 1845 (see Table 1.). The locality information given on labels is "Rocky Mountains" with no indication of the collector. Two possible clues to the original source of the specimens are the extant correspondence of Lord Derby and information concerning Joseph Burke.

Table 1. Summary of dates of publication and type specimens in the British Museum of Natural History.

NAME	DATE OF PUBLICATION (HEMMING, 1941)	SPECIMENS DONATED TO BMNH	
		1845	1847
<i>Parnassius (phoebus) smintheus</i>	1847	1♂	1♂
<i>Anthocharis (Euchloe) creusa</i>	1847	2♂	—
<i>Argynnis (Clossiana) astarte</i>	1847	1♀	—
<i>Melitea (Occidryas) anicia</i>	1847	1♀	1♂
<i>Erebia (disa) mancinus</i>	1849	1♂	1♂
<i>Chionobas (Oeneis) chryxus</i>	1849	2♀	—

The standard publications about British botanists and Rocky Mountain naturalists (Britten & Boulger, 1931; Ewan, 1950) gave Joseph Burke's itinerary in North America as between Fort Hall, Idaho and the upper reaches of the Platte River between 1844 and 1846. This is further substantiated by Allen (1848) who states that she encountered Mr. Burke just east of Soda Springs, Idaho on September 27, 1945. Thus, it seems possible that the type locality of *P. p. smintheus*, which Doubleday stated was collected in 1845, could be placed in southeastern Idaho or Wyoming. However, only two of the five remaining species, *Oeneis chryxus* and *Occidryas anicia* could have been collected in this area. *Euchloe creusa* occurs only as far south as Waterton Lakes Park, Alberta (Opler, 1970). *Clossiana astarte* occurs only as far south as Glacier National Park, Montana (Kohler, 1980). *Erebia disa mancinus* occurs only as far south as Canmore, Alberta (Bird & Kondla, pers. corr.). Examination of the type specimens of the three species which could have been collected between Fort Hall, Idaho and Platte River, Wyoming is of no help in deciding where they were collected, as phenotypic variation of individuals of any one population of any of these three species is notorious.

Regarding *Erebia disa mancinus*, *Euchloe creusa* and *Clossiana astarte*, one must assume that at least the type specimens of these three species were collected at one locality. To assume otherwise would imply that Lord Derby received butterfly specimens from a variety of localities and collectors when in fact, he normally did not receive any butterflies, only plants, birds and mammals. That one locality must be somewhere in the Canadian Rockies. *Euchloe creusa* and *Erebia disa* do not occur in the areas of Washington State and the Coast Range of British Columbia where disjunct populations of *Clossiana astarte* occur. The area of the Rocky Mountains where all three are known to occur extends from Pink Mt., British Columbia in the north to Canmore, Alberta in the south.

In the summer of 1845 and previously there was only one area of this region of the Rocky Mountains which was accessible to white men. The Hudson's Bay route connecting Fort Vancouver and other posts west of the Rocky Mountains with York Factory, Manitoba went from Jasper House, Alberta over Athabasca Pass to Boat Encampment, Columbia River, British Columbia. This was the only area where *Clossiana astarte* could have been collected. *Clossiana astarte* occurs only above timberline. Nowhere else did the Hudson's Bay route go near timberline. It may seem dogmatic to make such a statement. However, one must appreciate the control the Hudson's Bay Company had on the territory of its mandate. After

1821 when the Hudson's Bay Company, based in London, and the Northwest Company, based in Montreal, were merged the Hudson's Bay Company had complete control over the area. No one was allowed to travel through without the express permission of the company. Since the Hudson's Bay Company directed all supplies and travel routes they could enforce this control.

There are several possible sources of Lord Derby's Rocky Mountain material. The first non-Hudson's Bay employee to be in the vicinity of Jasper and Athabasca Pass was the naturalist Thomas Drummond (Soper, 1970; MacGregor, 1978). Drummond collected insects in the vicinity of Jasper in 1826 and 1827. These were described by Kirby (1837). None of these were butterflies, even though Kirby did describe butterflies collected by Drummond further east in Canada. Examination of Lord Derby's correspondence revealed no letters written to or received from Mr. Drummond (I.D. Wallace, pers. corr.). Thus, it does not seem likely he was the source of Lord Derby's specimens. David Douglas, the botanist, also passed through Athabasca Pass in 1827. Since his journals (Douglas, 1914) show he never collected insects, he could not have been the source of Lord Derby's specimens. Soper (1970) recorded still a third naturalist as going over Athabasca Pass in 1827 in company with Douglas. This was Edward Ermatinger. Ermatinger's journals (Ermatinger & White, 1913) show that he travelled over the pass May 1, 1827, October 8, 1827 and May 2, 1828. These dates are not remotely within the flight period of *C. astarte* and thus Ermatinger could not have been the source of *C. astarte*. These dates represent the dates that the Spring and Fall mail and furs always went over the pass (Judith Beattie and the author's examination of Hudson's Bay Archives, Winnipeg, Manitoba). Thus, a casual day's collecting by a Hudson's Bay employee while traveling with the cargo could not have been the source of Lord Derby's specimens. Only a factor at Jasper House or a non-Hudson's Bay employee, resident in the general area for a summer between the Spring and Fall movement of cargo, could have collected *C. astarte* and other butterflies. There is no evidence that any Factor at Jasper House collected natural history specimens or corresponded with Lord Derby. Soper (1970) indicated that the next non-Hudson's Bay Employee to reach Jasper area for a summer's residence was the artist Paul Kane in 1846. This is after Lord Derby donated the specimen of *C. astarte* to the British Museum.

The evidence suggests that the butterflies described by Doubleday were not collected near Jasper, even though this was the only possible place they could have been collected. However, in reaching this conclusion, the itinerary of Joseph Burke, the stated collector of *P. p. smintheus*, has been either ignored or stated incorrectly. Drury (1940), Macleod (1947), MacKelvey (1955) and Glover (1975) give accurate facts about Mr. Burke's itinerary. Letitia Hargrave's letters (Macleod, 1947) record meeting Mr. Burke in the Fall of 1843 at York Factory when he was preparing to leave for Edmonton House. Drury (1940) quoting a letter from the botanist C.A. Geyer to Sir William J. Hooker, states that Geyer encountered Mr. Burke at Fort Walla Walla in the Fall of 1844 after Mr. Burke had spent the previous summer at "Jasper's House". MacKelvey (1955) gives the first relatively full and accurate account of Joseph Burke's travels in North America based on sixteen letters written by Burke to Sir William Hooker. In these letters Burke stated that he spent the entire summer of 1844 near Jasper House using the same Indian guide and camping at the same spot as Thomas Drummond did in 1827 (MacKelvey, 1955). The long stay near Jasper was not in Burke's original plans. A heavy snow the previous winter prevented the usual Spring trip over Athabasca Pass. Also the weather during the summer of 1844 was very poor. Burke apparently collected butterflies to augment his otherwise poor collecting season. In a letter to Lord Derby sent from Jasper House dated 10 September

1844, Burke stated that he was sending "a small box of butterflies" (Glover, 1975). On 17 October 1846, Burke wrote to Hooker stating he was unable to ship any specimens to Hooker or Derby between 10 September 1844 and February 1846 when Burke arrived at Fort Vancouver (MacKelvey, 1955). There is no evidence to suggest that material sent in February 1846 or later contained butterflies. Only plant specimens were mentioned. Thus, Doubleday is presumably incorrect in stating *P. p. smintheus* material was collected in 1845. These specimens must have been collected in 1844. Since it is known that Burke sent Lord Derby a small package of butterflies from Jasper House, and there is no evidence that anyone else sent Lord Derby any butterflies from North America, I assume that specimens of all six species of Rocky Mountain butterflies presented to the British Museum of Natural History were collected by Burke near Jasper, Alberta.

Bird (1967) gives a detailed account of Thomas Drummond's itinerary in the Rocky Mountains pinpointing the site near Jasper which both Drummond and Burke (MacKelvey, 1955) used as a summer base camp. This site is "Stony Lake" (now Rock Lake: 53° 27'N, 118° 16'W), Alberta. This area in the vicinity of Rock Lake is the type locality of the Doubleday names.

Opler (1967) restricted the type locality of *Euchloe creusa* to the vicinity of Banff, Alberta on the recommendation of F.M. Brown. This has been shown to be incorrect. Pike (1980) restricted the type locality of *Clossiana astarte* to Mount Cheam, British Columbia, based on the fact that Laggan was unexplored and that "it seems reasonable to restrict the type locality of *B. astarte* to the locality nearest the major cities of British Columbia around 1800-1820". Pike assumed that British Columbia was well explored at the time *C. astarte* was collected, but this is not correct. Between 1800 and 1820 the only settlement on the west coast of British North America was Nootka Sound on the west coast of Vancouver Island (Ormsby, 1971). The next British settlement was Fort Vancouver on the Columbia River, established March 19, 1825 (Ormsby, 1971). There were no villages, let alone major cities. Both Victoria and Vancouver, British Columbia were established after Lord Derby's specimens were collected.

Even disregarding Pike's error about British Columbia settlements and assuming that specimens of *Clossiana astarte* may have reached Lord Derby via a second collector, a highly unlikely event as none of Lord Derby's voluminous and well preserved correspondence indicates such, Mount Cheam is not a possible locality where *C. astarte* could have been collected previous to 1846. From 1821 when the Hudson's Bay Company took over the Northwest Company, the major travel route was west from York Factory, Hudson Bay through Edmonton, Jasper House, Athabasca Pass, Boat Encampment on the Columbia River and then down the Columbia past Ford Colville to Fort Vancouver. Two attempts to follow the Fraser River west past Mount Cheam were unsuccessful and the route was abandoned. No natural history specimens were collected during these two attempts. Possible access to Mount Cheam via the west would have had to pass through Fort Langley, British Columbia. Fort Langley was established in the Spring of 1828 by George Barnston. Barnston's Fort Langley journals do not mention collecting or travels to any nearby mountains (Judith Beattie, pers. corr.). That October, A. McDonald was put in charge of Fort Langley where he remained until the summer of 1833. McDonald's biography (Cole, 1979) indicates that the only contact with the outside world was the yearly boat from Fort Vancouver. No mention is made of any traveling naturalist. Such an event would have been the highlight of any year when the annual boat from Fort Vancouver was the only contact with other Europeans. Further, there is no known correspondence between McDonald and Lord Derby. In 1833, McDonald was transferred to

Fort Colville where he remained until September 21, 1844. During the entire period, 1828-1844, McDonald carried on an extensive correspondence with other Hudson's Bay Company employees and was aware of all the events happening in British Columbia (Cole, 1979). In a letter to Hooker (Cole, 1979), McDonald states "I am extremely sorry to have to report that, with the single exception of our mutual friend Mr. Tolmie, the Gents, of the west side (B.C. & Wash.) are very reluctant to dab in anything connected with the vegetable or animal kingdom". The said Mr. Tolmie was based at Nisqually, Washington, far removed from the known range of *C. astarte*. After McDonald left, Fort Langley remained an outpost accessible only via boat from the west until 1848 (Ormsby, 1971). In the summer of 1848 the first successful attempt to cross the Cascades to Yale was completed. This change of route was forced on the Hudson's Bay Company by the loss of their routes on the Columbia River in the United States. The Yale route proved unusable and in 1849 Fort Hope was established as the western portal of the Coquihalla River Route from the east. Thus, there was no access to Mount Cheam until after *C. astarte* was collected. Pike (1980) was, therefore, incorrect in restricting the type locality of *C. astarte* to Mount Cheam.

In light of the evidence presented above, the type locality of *Parnassius smintheus*, *Anthocharis creusa*, *Argynnis astarte*, *Melitaea anicia*, *Erebia mancinus*, and *Chionobas chryxus* is formally restricted to the vicinity of Rock Lake, Alberta (53° 27'N, 118° 16'W).

LECTOTYPE DESIGNATIONS

The specimens on which Doubleday based his descriptions of the six species discussed above are all in the collection of the British Museum of Natural History. Five of the six species described are each represented in the British Museum of Natural History collection by two syntypes (see Table 1.). Doubleday did not label type specimens and thus lectotypes need to be selected. The sixth species, *Clossiana astarte*, is represented by a single female specimen which must be regarded as the holotype. The type specimen will be illustrated in a forthcoming paper on *C. astarte*. Since the discussion restricting the type locality requires the specimens be collected in 1844, I am using specimens presented by Lord Derby in 1845 as lectotypes. This is critical for *Parnassius phoebus smintheus* and *Occidryas anicia* where the specimens presented by Lord Derby in 1847 might later prove to have been collected between Fort Hall and the upper reaches of the Platte River instead of near Rock Lake, Alberta. This would radically alter historic usage of the names. For *Erebia disa mancinus* it would not be critical as this species could not have been collected in Wyoming or Idaho. However, the 1845 specimen has been isolated in the type collection and regarded as the type.

The lectotype of *Parnassius smintheus* Doubleday is the male specimen presented to the British Museum of Natural History in 1845 and labeled: Syntype, Rocky Mts. Pres. by Earl of Derby, 45-136, 33.6, spec. exam C. Eisner. The following label is being attached: Lectotype of *Parnassius smintheus*, designated by Jon H. Shepard, 1983. The male specimen labeled 47-74, Rocky Mts. Pres. by Earl of Derby, Type H.T. and photographed by C.F. dos Passos, B.M. photo #17177-17178, is not considered for lectotype or paralectotype designation. Nowhere in the literature has it been chosen as a lectotype, holotype, or in any way specified as the type specimen. The specimen designated as lectotype will be illustrated in a forthcoming paper on the type material of North American *Parnassius*. Barnes and McDunnough (1916) quote a letter from Sir George Hampson stating that the type series contained three males and one female. If this were true then one male and one female have been lost in the intervening years.

It is more likely that either Hampson or Barnes and McDunnough made an error, especially since on a following page Barnes and McDunnough misquote the figure numbers from Verity for illustrations of *Euchloe creusa*, another species of the same Doubleday material.

The lectotype of *Anthocharis creusa* Doubleday is the male specimen presented to the British Museum, of Natural History in 1845 and labeled: Type, Rocky Mtns., 45-136, Figure par R. Verity, Rhopal. Palaearctica, pl. 68, fig. 12. The following label is being attached: Lectotype of *Anthocharis creusa* Doubleday, designated by Jon H. Shepard, 1983. This specimen was photographed by C. F. dos Passos and is illustrated here (figs. 1, 2). The second male specimen, labeled: Rocky Mtns. 45-136, is designated a paralectotype and labeled such.

The lectotype of *Melitaea anicia* Doubleday is the female specimen presented to the British Museum of Natural History in 1845 and labeled: Rocky Mtns., Pres. by Earl of Derby, 45-136. The following label is being attached: Lectotype of *Melitaea anicia* Doubleday, designated by Jon H. Shepard, 1983. This female specimen is the one that most closely matches the figure in the original description. It was again illustrated by Gunder (1929). Gunder also illustrated the male specimen presented by Lord Derby in 1847 and labeled it "type δ anicia". This did not represent an official lectotype designation and is herein disregarded. This specimen is not considered a paralectotype.

The lectotype of *Erebia mancinus* Doubleday is the male specimen presented in 1845 and labeled: Rocky Mtns., 45-136, B.M. type no. Rh. 3581, *Erebia mancinus* δ Hew., agrees with the figure of type. F.A.H., 8-XI-01. The following label is being attached: Lectotype of *Erebia mancinus* Doubleday, designated by Jon H. Shepard, 1983. This specimen was photographed by C.F. dos Passos and is illustrated here (figs. 3, 4). The male specimen, labeled: Rocky Mtns., 47-74. Pres. by Lord Derby, is not considered a paralectotype.

The lectotype of *Chionobas chryxus* Doubleday is a female specimen presented in 1845 and labeled: Rocky Mtns., 45-136, type, B.M. Type no. Rh. 3845, *Chionobas chryxus* D. W. & H. ♀. The following label is being attached: Lectotype of *Chionobas chryxus* Doubleday, designated by Jon H. Shepard, 1983. The specimen was photographed by C.F. dos Passos and is illustrated here (figs. 5, 6). The second female specimen, labeled: Rocky Mtns., 45-136, is designated a paralectotype and labeled such.

ACKNOWLEDGEMENTS

The writing of this paper took an inordinate amount of checking of details which could not have been accomplished without the help of others. Robert Pyle, Greys River, Washington, originally checked the type specimens in the British Museum and located the correspondence of Lord Derby. F.H. Rindge of the American Museum of Natural History provided copies of C.F. dos Passos' photographs of type specimens of these Doubleday names. P.R. Ackery of the British Museum of Natural History re-examined the type series, and attached the lectotype labels. I.D. Wallace, Merseyside County Museum, checked details of Lord Derby's correspondence. D.A.E. Spalding, formerly of the Provincial Museum of Alberta, provided useful information concerning early Alberta naturalists. Charles Bird brought to my attention his work on Thomas Drummond. Judith Beattie of the Hudson's Bay Archives, Winnipeg, is to be especially thanked for the long hours she spent both independently and in helping the author to check many points. Though much of this does not appear in the manuscript, it was all necessary to insure the accuracy of the type locality designation. A.O. Bush and J.A. Powell are thanked for reviewing the manuscript and offering valuable suggestions. The editing skills and

typing efforts of my wife, Sigrid, are greatly appreciated.

LITERATURE CITED

- Allen, A.J. 1848. Ten years in Oregon. Mack, Andrus, & Co., Ithaca, N.Y. [I]-XVI, 17-399.
- Barnes, W. and J.H. McDunnough. 1916. Notes on North American diurnal Lepidoptera. Contributions to the Natural History of the Lepidoptera of North America. 3(2): 53-137, pls. 4-11.
- Bird, C.D. 1967. The mosses collected by Thomas Drummond in western Canada. 1825-1827. Bryologist. 70(2): 262-266.
- Britten, James and G.S. Boulger. 1931. A bibliographic index of deceased British and Irish botanists, 2nd ed. revised and completed by A.B. Rendle. Taylor and Francis, London. [I]-XXII, [1]-342.
- Brown, F.M. 1965. The types of Nymphalid butterflies described by William Henry Edwards Part 1. Argynrnninae. American Entomological Society, Transactions. 91(3): 233-350.
- Cole, J.M. 1979. Exile in the wilderness. Burns & MacEachern, Lim., Don Mills, Ontario [I]-XVIII, 1-268.
- Doubleday, Edward. 1847-1849. In Doubleday, E., J.O. Westwood, and W.C. Hewitson. 1847-1852. The genera of diurnal Lepidoptera: comprising their generic characters, a notice of their habits and transformations, and a catalogue of the species of each genus. Longman, Brown, Green, and Longmans, London. Vol. 1: [1]-250, pls. 1-30.
- Douglas, David. 1914. Journal kept by David Douglas during his travels in North America 1823-1827 together with a particular description of thirty-three species of American oaks and eighteen species of *Pinus*. Royal Horticultural Society, London. 1-293.
- Drury, C.M. 1940. Botanist in Oregon 1843-1844 for Kew Gardens, London. Oregon Historical Quarterly. 41(2): 182-188.
- Edwards, W.H. 1891. Description of a new species of *Argynnis* from Alberta Territory. Canadian Entomologist 23(9): 198-199.
- Elwes, H.J. 1889. A revision of the genus *Argynnis*. Entomological Society at London, Transactions. 1889: 535-575.
- Ermatinger, C.O. and James White. 1913. Edward Ermatinger's York Factory Express Journal, being a record of journeys made between Fort Vancouver and Hudson Bay in the years 1827-1828. Royal Society of Canada, Transactions. Ser. 3, Vol. 6, sec. II, 1912: 67-132, 1 map.
- Ewan, Joseph. 1950. Rocky Mountain naturalists. Univ. of Denver Press, Denver, Colorado. [I]-XIV, [1] - 358.
- Fletcher, James. 1908. Mountain sprites. Canadian Field Naturalist. 21 (12): 225-231.
- Glover, R.G. 1975. The man who did not go to California. Historical Papers Committee, Canadian Historical Association. 1975: 95-112.
- Gunder, J.D. 1929. The genus *Euphydryas* Scud. of Boreal America (Lepidoptera, Nymphalidae) Pan-Pacific Entomologist. 6(1): 1-8, pls. 1-16.
- Hemming, Francis, 1941. The dates of publication of the specific names first published by Doubleday (Ed.) *Genera of Diurnal Lepidoptera* and in the continuation thereof by Westwood (J.O.). Journal of the Society of Bibliography of Natural History. 1(11): 447-464.
- Kirby, William. 1837. Fauna Boreali-Americana. Vol. 4. Insects. Josiah Fletcher, Norwich,

- England. [I]–XXXIX, [1]–325, +(1), pls 1–7.
- Kohler, Steve. 1980. Checklist of Montana butterflies (Rhopalocera). *Journal of the Lepidopterists Society*. 34 (1): 1–19.
- MacGregor, J.G. 1978. John Rowand. Czar of the Prairies. Western Producer Prairie Books, Saskatoon, Saskatchewan. [I] – (X), [1] – (189).
- Macleod, M.A. ed. 1947. The letters of Letitia Hargrave. The Champlain Soc., Toronto. [I] – CLIV, [1] – 310.
- McKelvey, S.D. 1955. Botanical exploration of the Trans–Mississippi West, 1790–1840. The Arnold Arboretum of Harvard University, Jamaica Plains, Massachusetts. [I] – XL, [1] – 1144.
- Miller, L.D. and F.M. Brown. 1981. A catalogue/checklist of the butterflies of America north of Mexico. *The Lepidopterists' Society, Memoirs*. 2: [I] – VII, 1–280.
- Opler, P.A. 1967. Studies on the Nearctic *Euchloe*. Part 4. Type data and type locality restrictions. *Journal of Research on the Lepidoptera*. 5(3): 190–195.
- Opler, P.A. 1970. Studies on the Nearctic *Euchloe*. Part 5. Distribution. *Journal of Research on the Lepidoptera*. 7(2): 65–86.
- Ormsby, M.A. 1971. British Columbia: a history. The Macmillan Co. Canada Ltd., Toronto, Ontario. [I] – X, [1] – 566.
- Pike, E.M. 1980. Origins of tundra butterflies of Alberta. *Quaestiones Entomologicae*. 16: 555–596.
- Soper, J.D. 1970. The mammals of Jasper National Park, Alberta. Canadian Wildlife Service Report Series. 10: 1–80, map.
- Strecker, Herman. 1882. on *Argynnis astarte* Doubl. – Hew. and other matters. *Entomological News* 3: 218–220.
- Westwood, J.O. 1850–1852. In Doubleday, E., J.O. Westwood, and W.C. Hewitson. 1847–1852. The genera of diurnal Lepidoptera: comprising their generic characters, a notice of their habits and transformations and a catalogue of the species of each genus. Longman, Brown, Green, and Longmans, London. Vol. 2: 251–534, pls. 31–80, 1 supplemental plate.